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**Systems and Methods for Declarative
Localization of Web Services**

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1 **TECHNICAL FIELD**

2 The systems and methods described herein relate to providing web services
3 for multiple cultures. More particularly, the systems and methods described herein
4 relate to declarative localization of web services for multiple cultures.

5
6 **BACKGROUND**

7 The phenomenal growth of the Internet has extended computer-related
8 technology and web-based services to a vast number of countries around the
9 world. To realize the potential of such a market, providers of web-based services
10 must take into account a large number of different languages spoken by computer
11 users in all of these countries. Even in cultures that use similar languages (e.g.
12 U.S. English vs. U.K. English) the differences in the cultures and the language can
13 require different versions of web-based services for each culture.

14 Providing different versions of the same service can create maintenance
15 nightmares for web service providers. Consider a web site that supports one or
16 more media player applications, including providing artist and album information
17 to users. Maintaining a different version of all such information for each culture
18 reached by the service and keeping projects consistent with each other is virtually
19 impossible.

20 A previous attempt to solve this problem was to create a piece of shared
21 code that could be included in a given project and called whenever a particular
22 piece of content needed to be localized. While the solution works, it also causes a
23 significant amount of source code calls to be interspersed with standard HTML
24 tags, and other content. The approach is also somewhat error-prone and leads to
25 pages of content that can be difficult to read, debug and maintain.

SUMMARY

Systems and methods are described for declarative localization of web services. A "localize" attribute is described that uniquely identifies localized content for the final rendered element, be it the main text of that element, a localized attribute or any combination thereof. The "localize" attribute is stripped out during the rendering process, so it never reaches the client or agent, thus making the "localize" attribute compliant with HTML standards.

A separate satellite assembly (e.g. a dynamically linked library (DLL)) is maintained for each culture. When a request is received, a culture is identified from headers or from parameters of the request. The "localize" attribute directs processing to utilize content maintained in the satellite assembly associated with the identified culture. Processing then continues normally.

The declarative solution fits transparently into existing HTML specifications, guidelines and practices. The term "declarative" indicates that there are no procedural code calls (functions) in the content to be localized. This creates a much more distinct separation between the presented content and the corresponding logic for a given item of functionality. It is also much easier to read and understand - and, hence, to maintain - these two, distinct parts of a web-based service.

1 **BRIEF DESCRIPTION OF THE DRAWINGS**

2 The same numbers are used throughout the document to reference like
3 components and/or features.

4 Fig. 1 illustrates an exemplary network environment.

5 Fig. 2 illustrates exemplary server and client devices.

6 Fig. 3 is a flowchart illustrating a methodological implementation of
7 declarative localization of web-based services.

8 Fig. 4 illustrates a general computer environment, which can be used to
9 implement the techniques described herein.

DETAILED DESCRIPTION

The following depictions describe one or more exemplary systems and/or methods for declarative localization for web services. The examples described are but a few examples of various manners in which the subject matter of the appended claims may be implemented. The described examples are not intended to limit the scope of the appended claims in any manner, but are shown to accurately describe the best mode of carrying out the invention delineated by the claims.

The examples relate generally to HyperText Markup Language (HTML) content that is transmitted from a server to a client. Specifically, the examples relate to ASP.NET technology. ASP.NET (Active Server Pages) is a server-side scripting technique promulgated by MICROSOFT CORP® that enables server execution of scripts embedded in web pages. ASP.NET is included in the WINDOWS® family of operating systems.

ASP.NET is related to HTML and an ASP.NET file (a file having an .aspx extension) may contain HTML. In addition to HTML, an ASP.NET file may contain text or XML.

When a client web browser requests an HTML file from a server, an Internet Information Server (IIS) in the server passes the request to an ASP.NET module. An ASP.NET engine then compiles the requested file into a temporary Assembly, which is then executed on the server. The resultant output of this execution is returned to the client web browser, usually as a plain HTML file.

Although the present examples will focus on ASP.NET technology, it is noted that the examples may be implemented with any other form of web services

1 scripting technology without departing from the scope of the claimed systems and
2 methods.

3 The systems and methods described herein define a custom attribute –
4 “localize” - to be used inside of any HTML or ASP.NET control element to
5 identify localized content that should be applied to the application that includes the
6 control element. (The “localize” attribute conforms to HTML specifications,
7 which state that a user agent is to “safely ignore” any attributes that it does not
8 specifically understand.)

9 The format of a “localize” attribute value is a simple name-value pair
10 delineated by a colon (:) that is well known in the art (e.g. “name1:value1”).
11 Multiple name value pairs may be defined by further separating these pairs with a
12 semi-colon (;) (e.g. “name1:value1;name2:value2”). In all cases, whitespace next
13 to the delineations is ignored.

14 Within the value format, there is a single reserved name called “Text.”
15 This name refers to the normalized set of properties across all forms of HTML
16 elements or ASP.NET controls, in which the text is considered to be the “main”
17 visible text of the element. This normalization reduces the potential for error and
18 makes it easier to track what will be localized on all elements. For instance,
19 ASP.NET controls all have the “Text” property, whereas HTML elements may
20 have “InnerText,” “value” or “Text” depending on its type. In the localization
21 systems and methods described herein, each of these is simply referred to as
22 “Text.”

23 Any other values in the value format refer to attributes that will either be
24 changed or added to reflect their localized version. This allows localization of
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1 attributes in addition to the main text of a given element, e.g. the "src" of an image
2 tag, the "title" of an anchor tag, etc.

3 An example of the "localize" attribute and its value(s) conforming to a
4 standard HTML anchor tag follows:

5 `Default link text`

6 The example shown above will be discussed in greater detail, below.

7 **Exemplary Network Environment**

8 Fig. 1 illustrates an exemplary network environment 100. The exemplary
9 network environment 100 includes a server 102 that communicates over the
10 Internet 104 to provide web content 106 to multiple clients 108(1) – 108(n),
11 hereinafter referred to collectively as client(s) 108.

12 Although the server 102 is shown communicating with the clients 108 over
13 the Internet 104, it is noted that the server 102 may access the clients 108 via some
14 other type of network, such as a local area network (LAN), a wide access network
15 (WAN), or the like. In addition, a server 102 may sometimes communicate
16 directly with a client 108 via a direct connection via a modem, cable modem, etc.
17 (not shown).

18 The server 102 also includes a localization module 110 that is utilized to
19 localize the web content 106. In the present example, the web content 106 is
20 significantly generalized and may contain virtually any number of content pages
21 or items. Some of such content pages or items may not require the localization
22 modules. But if a content page or item is designed for a first culture, and a client
23 108 wishes to render the web content 106 for a second culture, the localization
24 module 110 is used to localize – or translate, to some extent – certain portions of
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1 the web content 106 to make the web content 106 appropriate for the second
2 culture.

3 The localization module 110 and its functionality are described in greater
4 detail, below, with respect to following figures.

5 Exemplary Localization Module

6 Fig. 2 is a simplified block diagram depicting a server 200 that includes an
7 exemplary localization module 202 similar to the localization module 108 shown
8 in Fig. 1. The localization module 202 includes a culture identification module
9 204, a localization values parser 206 and a key values parser 208. In addition, the
10 localization module 202 includes multiple satellite assemblies or dynamically
11 linked libraries (DLLs) 210(1), 210(2) through 210(n) – (hereinafter designated as
12 DLL(s) 210).

13 The culture identification module 204 is configured to identify a culture
14 associated with a page request. The identification may be accomplished by
15 parsing headers or by recognizing one or more parameters that identify the
16 appropriate culture.

17 The localization values parser 206 is configured to identify a “localize”
18 attribute, match “Text” keyword values to element types, add new or existing
19 attributes and to strip the “localize” attribute and associated values from the
20 original element before passing the element to a user agent, such as a client.

21 The key values parser 208 is utilized by the localization values parser 206
22 to identify key values in an element and redirect or substitute localized values for
23 the key values. In the previously stated example, the values in the string

24 (localize=”Text:link123;Title:title123),
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1 are parsed into separate values that contain identifiers used for later lookup
2 functions. Here, the text of the element in question is replaced by the value of the
3 localized content with the identifier of "link123" (i.e. "link123" is the identifier of
4 the localized content contained within the satellite assembly for the current
5 culture).

6 The DLLs 210 each correspond to a culture and contain localized values
7 that are to be substituted for original values in an HTML page. There is one DLL
8 for each supported culture. When an additional culture is desired to be supported,
9 a new DLL is developed for that culture. No amendment to a web page is
10 necessary.

11 The function of the elements shown and described in Fig. 2 will be
12 discussed in greater detail with respect to the exemplary methodological
13 implementation shown in Fig. 3, below.

14 **Exemplary Methodological Implementation**

15 Fig. 3 is a flowchart 300 illustrating a methodological implementation of
16 declarative localization of web-based services. In the following discussion,
17 continuing reference will be made to the elements and reference numerals shown
18 in Fig. 2.

19 At block 302, the server 200 receives a page request from a client 110. The
20 page request is a standard request for web content to be transmitted from the
21 server 200 to the client 110. At block 304, the culture identification module 204
22 attempts to identify a culture associated with the request from the page request.
23 This may be done by identifying headers associated with a particular culture,
24 identifying culture identifiers within headers, by identifying culture parameters
25 associated with the page request, or by any other method known in the art. If a

1 culture cannot be identified, then a default culture is used. In at least one
2 implementation, the default culture is US-English.

3 If the identified culture is available, i.e., if there is a satellite assembly
4 stored in the localization module associated with the identified culture, ("Yes"
5 branch, block 306) then the localization module 202 references the DLL 210
6 associated with that culture at block 308. In at least one implementation, the
7 localization module 202 may access a remote device to locate an appropriate DLL
8 210 if the DLL 210 is not already stored at the server 200.

9 If there is no DLL 210 associated with the identified culture ("No" branch,
10 block 306) then the localization module 202 sets to the default culture at block
11 310. Again, in one implementation, the default culture is US-English.

12 At block 312, the localization values parser 206 parses the localization
13 attributes to determine attributes that are to be localized. During this process, the
14 key values parser 208 parses key values located in the localization attributes and
15 associates elements with those key values.

16 At block 314, the localization module strips the "localize" attribute from
17 the original element before continuing to process the page at block 316. The page
18 processing subsequent to the localization includes running any scripts or page-
19 behind code associated with the web page. By taking care of the localization first,
20 the appropriate page attributes are known before the page is processed and sent to
21 the client.

22 The following discussion is a continuation of the example referenced
23 previously, where a page request contains the following attributes and values in a
24 standard HTML anchor tag:

25 `Default link text`

1 If the requesting agent is making the request in US English, no action need
2 be taken except to remove the "localize" attribute and its value(s) from the
3 element upon final rendering. However, if the request is made in any other culture
4 the system will attempt to load a satellite assembly associated with that particular
5 culture, then replace the text "Default link text" with the text found at the id of
6 "link123" in that assembly. Furthermore, the attribute value "A Title" will be
7 replaced by any localized text found at the id of "title 123" in the same satellite
8 assembly.

9 It is noted that the transformation takes place before the page-specific code
10 runs for a given page. This ensures that runtime calculations of string length are
11 accurate for any given culture as these calculations will occur on already localized
12 content.

13 Particularly relative to WINDOWS®, to participate in this system a page
14 must directly or indirectly inherit from the "Page" Class. Also, the ASP.NET
15 guidelines for satellite assembly naming and locations must be followed for the
16 system to locate the localized content. The described functionality is implemented
17 in the Page Class. Upon start-up, this base class will scan the entire control tree of
18 the derived class looking for, inter alia, the "localize" attribute on any elements
19 that are also marked with the "runat" attribute value equal to "server." For
20 example,

21 `Default text here`.

22 Once an element is found to contain these attributes, the system ascertains
23 the culture in which the request is being made. The system will then attempt to
24 load the corresponding localized string(s) from the satellite assembly created in
25 that culture and replace the existing string values on that element. If this should

1 fail for any reason, the system will revert to a default culture (US-English) and the
2 error may be handled by the page creator.

3 The value of the "localize" attribute is a collection of names of the string
4 resources to load from the appropriate satellite assembly. For instance, using the
5 example above, a satellite assembly for each supported culture would need to
6 include the string property named "123" with values that match that string for the
7 particular culture.

8 The directory structure for each project should follow the standard .net
9 guidelines for localization. The localized content exists in a satellite assembly
10 located in a specifically named subdirectory of the project's \bin directory. All of
11 the assemblies are similarly named, and are differentiated by their parent folder.
12 For instance, the default US English Satellite Assembly would exist in the \bin\en-
13 US directory and be named <projectname>.resources.dll. One example of such a
14 name is RadioTuner.resources.dll.

15 As previously noted, while the localization framework will normally derive
16 the current culture from a Request object on each page view, a page developer can
17 override this behavior by including a different culture in the query string. In at
18 least one implementation, the parameter is "culture" as in the following example:

19 **http://bluebook/local/default.aspx?culture=es**

20 which sets the culture for traditional Spanish, and

21 **http://bluebook/local/default.aspx?culture=es-cl**

22 which sets the culture for the request to Chilean Spanish.

23 In one implementation, in cases where a basic version of a culture is
24 available but a more specific version of a culture is not, the default culture is set to
25 the basic version. In the example presented above, if Chilean Spanish is not

1 available, but traditional Spanish is, the system will automatically default to
2 traditional Spanish.

3 Using the techniques described above, web content pages can be supported
4 for a number of different cultures with little confusion. Each web page can remain
5 intact while supporting the different cultures, since the techniques are declarative
6 and require no external procedural calls within the page. As a result, maintaining
7 cultural-specific web pages may be accomplished with a minimal amount of
8 resource overhead.

9 10 **Exemplary Operating Environment**

11 Fig. 4 illustrates a general computer environment 400, which can be used to
12 implement the techniques described herein. The computer environment 400 is
13 only one example of a computing environment and is not intended to suggest any
14 limitation as to the scope of use or functionality of the computer and network
15 architectures. Neither should the computer environment 400 be interpreted as
16 having any dependency or requirement relating to any one or combination of
17 components illustrated in the exemplary computer environment 400.

18 Computer environment 400 includes a general-purpose computing device in
19 the form of a computer 402. Computer 402 can be, for example, a client 110 or
20 server 102 of Fig. 1. The components of computer 402 can include, but are not
21 limited to, one or more processors or processing units 404, a system memory 406,
22 and a system bus 408 that couples various system components including the
23 processor 404 to the system memory 406.

24 The system bus 408 represents one or more of any of several types of bus
25 structures, including a memory bus or memory controller, a peripheral bus, an

1 accelerated graphics port, and a processor or local bus using any of a variety of
2 bus architectures. By way of example, such architectures can include an Industry
3 Standard Architecture (ISA) bus, a Micro Channel Architecture (MCA) bus, an
4 Enhanced ISA (EISA) bus, a Video Electronics Standards Association (VESA)
5 local bus, and a Peripheral Component Interconnects (PCI) bus also known as a
6 Mezzanine bus.

7 Computer 402 typically includes a variety of computer readable media.
8 Such media can be any available media that is accessible by computer 402 and
9 includes both volatile and non-volatile media, removable and non-removable
10 media.

11 The system memory 406 includes computer readable media in the form of
12 volatile memory, such as random access memory (RAM) 410, and/or non-volatile
13 memory, such as read only memory (ROM) 412. A basic input/output system
14 (BIOS) 414, containing the basic routines that help to transfer information
15 between elements within computer 402, such as during start-up, is stored in ROM
16 412. RAM 410 typically contains data and/or program modules that are
17 immediately accessible to and/or presently operated on by the processing unit 404.

18 Computer 402 may also include other removable/non-removable,
19 volatile/non-volatile computer storage media. By way of example, Fig. 4
20 illustrates a hard disk drive 416 for reading from and writing to a non-removable,
21 non-volatile magnetic media (not shown), a magnetic disk drive 418 for reading
22 from and writing to a removable, non-volatile magnetic disk 420 (e.g., a "floppy
23 disk"), and an optical disk drive 422 for reading from and/or writing to a
24 removable, non-volatile optical disk 424 such as a CD-ROM, DVD-ROM, or other
25 optical media. The hard disk drive 416, magnetic disk drive 418, and optical disk

1 drive 422 are each connected to the system bus 408 by one or more data media
2 interfaces 426. Alternatively, the hard disk drive 416, magnetic disk drive 418,
3 and optical disk drive 422 can be connected to the system bus 408 by one or more
4 interfaces (not shown).

5 The disk drives and their associated computer-readable media provide non-
6 volatile storage of computer readable instructions, data structures, program
7 modules, and other data for computer 402. Although the example illustrates a hard
8 disk 416, a removable magnetic disk 420, and a removable optical disk 424, it is to
9 be appreciated that other types of computer readable media which can store data
10 that is accessible by a computer, such as magnetic cassettes or other magnetic
11 storage devices, flash memory cards, CD-ROM, digital versatile disks (DVD) or
12 other optical storage, random access memories (RAM), read only memories
13 (ROM), electrically erasable programmable read-only memory (EEPROM), and
14 the like, can also be utilized to implement the exemplary computing system and
15 environment.

16 Any number of program modules can be stored on the hard disk 416,
17 magnetic disk 420, optical disk 424, ROM 412, and/or RAM 410, including by
18 way of example, an operating system 426, one or more application programs 428,
19 other program modules 430, and program data 432. Each of such operating
20 system 426, one or more application programs 428, other program modules 430,
21 and program data 432 (or some combination thereof) may implement all or part of
22 the resident components that support the distributed file system.

23 A user can enter commands and information into computer 402 via input
24 devices such as a keyboard 434 and a pointing device 436 (e.g., a "mouse").
25 Other input devices 438 (not shown specifically) may include a microphone,

1 joystick, game pad, satellite dish, serial port, scanner, and/or the like. These and
2 other input devices are connected to the processing unit 404 via input/output
3 interfaces 440 that are coupled to the system bus 408, but may be connected by
4 other interface and bus structures, such as a parallel port, game port, or a universal
5 serial bus (USB).

6 A monitor 442 or other type of display device can also be connected to the
7 system bus 408 via an interface, such as a video adapter 444. In addition to the
8 monitor 442, other output peripheral devices can include components such as
9 speakers (not shown) and a printer 446 which can be connected to computer 402
10 via the input/output interfaces 440.

11 Computer 402 can operate in a networked environment using logical
12 connections to one or more remote computers, such as a remote computing device
13 448. By way of example, the remote computing device 448 can be a personal
14 computer, portable computer, a server, a router, a network computer, a peer device
15 or other common network node, and the like. The remote computing device 448 is
16 illustrated as a portable computer that can include many or all of the elements and
17 features described herein relative to computer 402.

18 Logical connections between computer 402 and the remote computer 448
19 are depicted as a local area network (LAN) 450 and a general wide area network
20 (WAN) 452. Such networking environments are commonplace in offices,
21 enterprise-wide computer networks, intranets, and the Internet.

22 When implemented in a LAN networking environment, the computer 402 is
23 connected to a local network 450 via a network interface or adapter 454. When
24 implemented in a WAN networking environment, the computer 402 typically
25 includes a modem 456 or other means for establishing communications over the

1 wide network 452. The modem 456, which can be internal or external to computer
2 402, can be connected to the system bus 408 via the input/output interfaces 440 or
3 other appropriate mechanisms. It is to be appreciated that the illustrated network
4 connections are exemplary and that other means of establishing communication
5 link(s) between the computers 402 and 448 can be employed.

6 In a networked environment, such as that illustrated with computing
7 environment 400, program modules depicted relative to the computer 402, or
8 portions thereof, may be stored in a remote memory storage device. By way of
9 example, remote application programs 458 reside on a memory device of remote
10 computer 448. For purposes of illustration, application programs and other
11 executable program components such as the operating system are illustrated herein
12 as discrete blocks, although it is recognized that such programs and components
13 reside at various times in different storage components of the computing device
14 402, and are executed by the data processor(s) of the computer.

15 Various modules and techniques may be described herein in the general
16 context of computer-executable instructions, such as program modules, executed
17 by one or more computers or other devices. Generally, program modules include
18 routines, programs, objects, components, data structures, etc. that perform
19 particular tasks or implement particular abstract data types. Typically, the
20 functionality of the program modules may be combined or distributed as desired in
21 various embodiments.

22 An implementation of these modules and techniques may be stored on or
23 transmitted across some form of computer readable media. Computer readable
24 media can be any available media that can be accessed by a computer. By way of
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1 example, and not limitation, computer readable media may comprise “computer
2 storage media” and “communications media.”

3 “Computer storage media” includes volatile and non-volatile, removable
4 and non-removable media implemented in any method or technology for storage
5 of information such as computer readable instructions, data structures, program
6 modules, or other data. Computer storage media includes, but is not limited to,
7 RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM,
8 digital versatile disks (DVD) or other optical storage, magnetic cassettes, magnetic
9 tape, magnetic disk storage or other magnetic storage devices, or any other
10 medium which can be used to store the desired information and which can be
11 accessed by a computer.

12 “Communication media” typically embodies computer readable
13 instructions, data structures, program modules, or other data in a modulated data
14 signal, such as carrier wave or other transport mechanism. Communication media
15 also includes any information delivery media. The term “modulated data signal”
16 means a signal that has one or more of its characteristics set or changed in such a
17 manner as to encode information in the signal. By way of example, and not
18 limitation, communication media includes wired media such as a wired network or
19 direct-wired connection, and wireless media such as acoustic, RF, infrared, and
20 other wireless media. Combinations of any of the above are also included within
21 the scope of computer readable media.

22 Although the description above uses language that is specific to structural
23 features and/or methodological acts, it is to be understood that the invention
24 defined in the appended claims is not limited to the specific features or acts
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1 described. Rather, the specific features and acts are disclosed as exemplary forms
2 of implementing the invention.
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